CLAIMS

What is claimed is:

1. In a receiver of a multicarrier wireless communications system, a method to perform channel estimation to suppress noise jitter over a bandwidth of interest, comprising:

transforming frequency domain channel estimates into the time domain;

suppressing noise jitter in the time domain channel estimates; and

transforming the noise suppressed time domain channel estimates back to the frequency domain for frequency domain equalization.

2. A method as in claim 1, where the channel estimation is based on minimum mean-squared error (MMSE) estimation over comb-type pilot signals.

3. A method as in claim 1, where the frequency domain channel estimates are transformed into the time domain channel estimates by use of an inverse fast Fourier transform (IFFT) function having a length of the number of pilots per symbol.

4. A method as in claim 1, where suppressing noise jitter comprises using a predefined threshold of actual power or accumulative power to minimize the noise jitter over the bandwidth.

5. A method as in claim 1, where suppressing noise jitter comprises using channel delay estimates made for frame synchronization purposes, preserving the channel estimates at actual tap delays and setting the others to zero.

6. A method as in claim 4, where suppressing noise jitter comprises preserving time-domain channel estimates with power larger than a predefined power threshold, and setting to zero those channel estimates with power less than the predefined power

threshold as follows,

$$\tilde{h}(n)=\begin{cases}\hat{h}(n) & if \left|\hat{h}(n)\right|^2 > P_t \\ 0 & otherwise\end{cases},$$

where $|\ |$ implies the absolute value, P_t=pP_{all} is the power threshold, p is a weighting factor, and $P_{all} = \sum_{n=0}^{L_p-1}\left|\hat{h}(n)\right|^2$ is the total power of the time domain channel estimates.

7. A method as in claim 6, where in a time varying environment the power threshold is adapted based on noise and interference power.

8. A method as in claim 4, where suppressing noise jitter comprises ordering time-domain channel estimates as:

$$i_n = \text{ORDER}\left\{\left|\hat{h}(n)\right|^2\right\} \quad n = 0,1,2,\cdots,L_P - 1,$$

where ORDER{} is a function to sort elements in ascending order and return an array of indices, further comprising accumulating the power of the time-domain channel estimates from largest to smallest, and setting a threshold on the accumulated power for zeroing the channel estimates outside of the threshold region in accordance with:

$$\tilde{h}(n)=\begin{cases}\hat{h}(i_n) & if \ \sum_{m=n}^{L_p-1}\left|\hat{h}(i_m)\right|^2 < \rho P_{all},\ n = L_p - 1,\cdots,0 \\ 0 & otherwise\end{cases},$$

where $90\% < \rho < 95\%$ is a percentage factor typically defined to be about one.

9. A method as in claim 5, where suppressing noise jitter comprises preserving those time domain channel estimates at actual channel tap delays and setting the remainder to zero by:

$$\tilde{h}(n)=\begin{cases}\hat{h}(n) & if \ n \in \Gamma,\ n = 0,\cdots,L_p - 1 \\ 0 & otherwise\end{cases},$$

where $\Gamma = \{\tau_l\} \quad l = 1,\cdots,L$ is a vector of the tap delays.

10. A method as in claim 1, where the noise suppressed time domain channel estimates are transformed back to frequency domain for frequency domain equalization by a FFT operation having a length of the number of all subcarriers.

11. A method as in claim 1, where the channel estimation is based on a least squares estimation over comb-type pilot signals.

12. A receiver of a multicarrier wireless communications system, comprising:

a channel estimator;

a frequency equalizer; and

a channel estimation interpolation function to suppress noise jitter over a bandwidth of interest, comprising a unit to transform frequency domain channel estimates into the time domain; a unit to suppress the noise jitter in the time domain channel estimates and a unit to transform the noise suppressed time domain channel estimates back to the frequency domain for input to said frequency equalizer.

13. A receiver as in claim 12, where said channel estimator performs minimum mean-squared error (MMSE) estimation over comb-type pilot signals.

14. A receiver as in claim 12, where frequency domain channel estimates are transformed into the time domain channel estimates by use of an inverse fast Fourier transform (IFFT) function having a length of a number of pilots per symbol.

15. A receiver as in claim 12, where said channel estimation interpolation function uses a predefined threshold of actual power or accumulative power to minimize the noise jitter over the bandwidth.

16. A receiver as in claim 12, where said channel estimation interpolation function uses channel delay estimates made for frame synchronization purposes, and preserves channel estimates at actual tap delays and sets the others to zero.

17. A receiver as in claim 15, where said channel estimation interpolation function

preserves time-domain channel estimates with power larger than a predefined power threshold, and sets to zero those channel estimates with power less than the predefined power threshold as follows,

$$\tilde{h}(n)=\begin{cases}\hat{h}(n) & if\ \left|\hat{h}(n)\right|^2 > P_t \\ 0 & otherwise\end{cases},$$

where | | implies the absolute value, P_t=pP_{all} is the power threshold, p is a weighting factor, and $P_{all}=\sum_{n=0}^{L_p-1}\left|\hat{h}(n)\right|^2$ is the total power of the time domain channel estimates.

18. A receiver as in claim 17, where in a time varying environment the power threshold is adapted based on noise and interference power.

19. A receiver as in claim 15, where said channel estimation interpolation function orders time-domain channel estimates as:

$$i_n = \mathrm{ORDER}\left\{\left|\hat{h}(n)\right|^2\right\} \quad n = 0,1,2,\cdots,L_P-1,$$

where ORDER{} is a function to sort elements in ascending order and return an array of indices, and further comprises an accumulator to accumulate the power of the time-domain channel estimates from largest to smallest and sets a threshold on the accumulated power for zeroing the channel estimates outside of the threshold region in accordance with:

$$\tilde{h}(n)=\begin{cases}\hat{h}(i_n) & if\ \sum_{m=n}^{L_p-1}\left|\hat{h}(i_m)\right|^2 < \rho P_{all},\ n = L_p-1,\cdots,0 \\ 0 & otherwise\end{cases},$$

where $90\% < \rho < 95\%$ is a percentage factor typically defined to be about one.

20. A receiver as in claim 16, where said channel estimation interpolation function preserves time domain channel estimates at actual channel tap delays and sets the remainder to zero by:

$$\tilde{h}(n)=\begin{cases}\hat{h}(n) & if\ n\in\Gamma,\ n=0,\cdots,L_p-1 \\ 0 & otherwise\end{cases},$$

where $\Gamma=\{\tau_l\}\quad l=1,\cdots,L$ is a vector of the tap delays.

21. A system as in claim 12, where the noise suppressed time domain channel estimates are transformed back to frequency domain for frequency domain equalization by a FFT operation having a length of the number of all subcarriers.

22. A system as in claim 12, where the channel estimation is based on a least squares estimation over comb-type pilot signals.

23. A receiver of an orthogonal frequency division multiplex (OFDM) multicarrier wireless communications system, comprising:

a channel estimator operable to perform estimation over received pilot signals to obtain channel estimates;

an equalizer operating in the frequency domain; and

a channel estimation interpolation function to suppress noise over a bandwidth of interest, comprising a unit to transform frequency domain channel estimates into the time domain; a unit to suppress the noise in the time domain channel estimates and a unit to transform the noise suppressed time domain channel estimates back to the frequency domain for input to said equalizer, where frequency domain channel estimates are transformed into the time domain channel estimates by use of an inverse fast Fourier transform (IFFT) function having a length of a number of pilots per OFDM symbol, and where the noise suppressed time domain channel estimates are transformed back to the frequency domain for frequency domain equalization by a FFT operation having a length of the number of all subcarriers.

24. A receiver as in claim 23, where said channel estimator is operable to perform one of minimum mean-squared error (MMSE) or least squares estimation.

25. A receiver as in claim 23, where said channel estimation interpolation function uses a predefined threshold of actual power or accumulative power to minimize the noise over the bandwidth.

26. A receiver as in claim 22, where said channel estimation interpolation function uses channel delay estimates made for frame synchronization purposes, and preserves channel estimates at actual tap delays and sets the others to zero.

27. A receiver as in claim 25, where said channel estimation interpolation function preserves time-domain channel estimates with power larger than a predefined power threshold, and sets to zero those channel estimates with power less than the predefined power threshold as follows,

$$\tilde{h}(n)=\begin{cases}\hat{h}(n) & if\left|\hat{h}(n)\right|^2 > P_t \\ 0 & otherwise\end{cases},$$

where | | implies the absolute value, $P_t = pP_{all}$ is the power threshold, p is a weighting factor, and $P_{all}=\sum_{n=0}^{L_p-1}\left|\hat{h}(n)\right|^2$ is the total power of the time domain channel estimates.

28. A receiver as in claim 27, where in a time varying environment the power threshold is adapted based on noise and interference power.

29. A receiver as in claim 25, where said channel estimation interpolation function orders time-domain channel estimates as:

$$i_n = \text{ORDER}\left\{\left|\hat{h}(n)\right|^2\right\} \quad n = 0,1,2,\cdots,L_P-1,$$

where ORDER{} is a function to sort elements in ascending order and return an array of indices, and further comprises an accumulator to accumulate the power of the time-domain channel estimates from largest to smallest and sets a threshold on the accumulated power for zeroing the channel estimates outside of the threshold region in accordance with:

$$\tilde{h}(n)=\begin{cases}\hat{h}(i_n) & if \sum_{m=n}^{L_p-1}\left|\hat{h}(i_m)\right|^2 < \rho P_{all},\ n = L_p-1,\cdots,0 \\ 0 & otherwise\end{cases},$$

where $90\% < \rho < 95\%$ is a percentage factor typically defined to be about one.

30. A receiver as in claim 26, where said channel estimation interpolation function

preserves time domain channel estimates at actual channel tap delays and sets the remainder to zero by:

$$\tilde{h}(n)=\begin{cases}\hat{h}(n) & if\ \ n\in\Gamma,\ n=0,\cdots,L_p-1\\ 0 & otherwise\end{cases},$$

where $\Gamma=\{\tau_l\}\ \ l=1,\cdots,L$ is a vector of the tap delays.

31. A receiver as in claim 23, where said received pilot signals comprise comb-type pilot signals.

32. A receiver as in claim 23, embodied in a cellular telephone device.